

*The Eclipse of Archilochus.**(Extract from a letter from Professor E. Millosevich.)*

In the important paper on ancient eclipses of the Sun, by Mr. Nevill, *Monthly Notices*, vol. lxvi. No. 7, speaking (on p. 410) of the eclipse of Archilochus, identified by Oppolzer, by myself, and by Cowell with that of —647 April 6, total at Thasos, he says, "But this is considerably later than the date usually assigned to this poet."

The age in which Archilochus lived is determined by the fact that he mentions King Gyges of Lydia, and the catastrophe of Magnesia which occurred towards the *end* of the reign of Gyges or a *little later*. Gugu (Gyges) is mentioned as a contemporary in an inscription of the Assyrian king Assur-bani-pal, who reigned *circa* 668 to 626 B.C. The inscription is later than B.C. 662. Archilochus therefore cannot have lived before the middle of the seventh century. This is the opinion of Julius Beloch, the eminent historian of ancient Greece, from whom I had the above information.

Star Reductions. By W. Ernest Cooke, B.A.

The reduction of star places from apparent to mean positions, and *vice versa*, occupies such a large portion of observatory routine that no apology is needed for bringing before the notice of the R.A.S. a new method of attacking this troublesome matter.

If the formulæ of reduction (*Nautical Almanac*, 1906, p. 305) be examined it will be found that they may conveniently be divided into two parts :

(1) Functions of \odot and L , and therefore of t

(2) „ „ „ \oslash

and a few terms which may for most work be considered as negligible.

I propose that

(3) Tables be formed, giving the values of

$$A^{\circ}a + B^{\circ}b + C^{\circ}c + D^{\circ}d = K_{\ast} \text{ say}$$

and

$$A^{\circ}a' + B^{\circ}b' + C^{\circ}c' + D^{\circ}d' = K_{\ast} \text{ ,,}$$

for each degree of N.P.D. and every 10^m of R.A., and for each tenth day throughout the year, commencing with $t = 0$ or $L = 280^{\circ}$.

In this case C° and D° are computed with the elimination of terms in \oslash and $2\oslash$, also ζ , &c.

I shall refer to these as the *Standard Tables*.

(4) In addition, an annual table is required, giving N_a and N_s , the missing terms in δ and 2δ , and this is computed as follows :

Quantities x and y are tabulated for each 5° of δ giving

$$x = -\cdot342 \sin \delta + \cdot004 \sin 2\delta$$

$$y = -9\cdot21 \cos \delta + \cdot09 \cos 2\delta$$

Then $N_a = cx + dy$ $N_s = c'x + d'y$

(5) The reduction for any star is then simply the sum of the two quantities K and N , which can be taken from the tables by simple interpolation.

(6) The preparation of the Standard Tables is a rather lengthy undertaking, but the tables, when computed, will be practically correct for centuries. It will not be found so arduous as it might at first appear, because there is so much numerical repetition, with opposite signs in the different quadrants, and interpolation can be freely used.

(7) The annual table also is not a very serious affair. It must be remembered that δ only changes about 20° annually, and five values of t (0, 100, 200, 300, 400) are ample. In fact for many purposes two will suffice. The changes are so slight that every 2^h in R.A. and every 5° or even 10° in N.P.D. will be found sufficient for the main computation.

(8) As a matter of practice many observatories will find the computation of the annual table (even if it is not undertaken as a regular habit by the compilers of National Ephemerides) a very simple matter ; for their observations during any one year may extend over only a few degrees in declination.

(9) Take my own case. The transit work of the Perth Observatory is at present limited to the zone between -31° and $-41^\circ \delta$. I have prepared Standard Tables for -36° , and the variations in every case for an increase and decrease of 5° in N.P.D., computed with a simple differential formula. These tables are good for all time.

Then for each year I have to compute :

$$N_a = cx + dy$$

$$I_a = c_a x + d_a y$$

$$D_a = c_a x + d_a y$$

$$N_s = c'x + d'y$$

where I_a and D_a mean the change in the annual value for an increase or decrease of 5° in N.P.D.

c and d are the ordinary values for 36° .

c_a , c_d &c. are the variation in c and d for an increase or decrease of 5° in N.P.D., &c.

I compute for 0^h , 2^h , 4^h , &c., and interpolate to half hours, and find that five values of t (0, 100, 200, 300, and 400 days) are more than sufficient.

Values of A° , B° , C° , D° , for every tenth day :

$$A^\circ = -20''\cdot47 \cos \omega \cos \odot \quad B^\circ = -20''\cdot47 \sin \odot$$

$$C^\circ = t - ''\cdot025 \sin 2L \quad D^\circ = - ''\cdot551 \cos 2L$$

Date.	t in Days.	A° .	B° .	C° .	D° .	$3^{\circ}72'0''$.
Jan. 1	0	- 3'25	+ 20'16	'008	+ '52	'026
11	10	6'46	19'22	'043	'42	'133
21	20	9'48	17'67	'076	'28	'234
31	30	12'19	15'56	'107	+ '10	'328
Feb. 10	40	14'52	12'98	'134	- '08	'412
20	50	16'37	10'01	'159	'26	'488
Mar. 2	60	17'73	6'74	'181	'41	'556
12	70	18'54	+ 3'28	'201	'51	'617
22	80	18'78	- 0'26	'220	'55	'676
Apr. 1	90	18'46	3'77	'239	'52	'733
11	100	17'60	7'14	'259	'44	'795
21	110	16'22	10'32	'280	'30	'860
May 1	120	14'39	13'14	'304	- '13	'935
11	130	12'15	15'60	'331	+ '06	1'017
21	140	9'60	17'61	'361	'24	1'108
31	150	6'76	19'10	'393	'40	1'207
June 10	160	3'76	20'06	'428	'50	1'314
20	170	- 0'66	20'45	'464	'55	1'423
30	180	+ 2'46	20'29	'499	'53	1'534
July 10	190	5'52	19'57	'534	'45	1'641
20	200	8'41	18'30	'568	'32	1'744
30	210	11'08	16'52	'599	+ '15	1'840
Aug. 9	220	13'45	14'29	'627	- '03	1'926
19	230	15'45	11'63	'652	'22	2'004
29	240	17'01	8'66	'675	'37	2'074
Sept. 8	250	18'10	5'40	'696	'49	2'138
18	260	18'59	- 1'98	'715	'55	2'197
28	270	18'72	+ 1'49	'734	'54	2'255
Oct. 8	280	18'22	4'97	'753	'47	2'314
18	290	17'16	8'31	'774	'34	2'379
28	300	15'58	11'43	'798	- '18	2'450
Nov. 7	310	13'53	14'21	'824	+ '01	2'530
17	320	11'04	16'57	'853	'20	2'620
27	330	8'21	18'42	'884	'36	2'717
Dec. 7	340	5'09	19'69	'918	'48	2'821
17	350	+ 1'82	20'37	'954	'54	2'931
27	360	- 1'50	20'41	'990	'55	3'041
37	370	- 4'79	+ 19'80	1'025	+ '48	3'147

The figures are natural numbers, not logarithms, and it is suggested that $A^\circ a$, &c., be computed with Crelle's "Rechentafeln."

Values of x and y :

$$x = -\cdot342 \sin \Omega + \cdot004 \sin 2 \Omega$$

$$y = -\cdot921 \cos \Omega + \cdot09 \cos 2 \Omega$$

Argument Ω . (Long. of Moon's Ascending Node.)

Ω .	x .	y .	Ω .	x .	y .	Ω .	x .	y .	Ω .	x .	y .
0°	·000	-9·12	90°	·342	-0·09	180°	·000	+9·30	270°	·342	-0·09
	5·8	0·8		0·2	16·0		6·0	0·6		0·4	16·0
5	·029	-9·08	95	·341	+0·71	185	+·030	+9·27	275	+·340	-0·89
	5·8	2·0		0·6	16·0		6·0	2·2		0·8	15·8
10	·058	-8·98	100	·338	+1·51	190	+·060	+9·16	280	+·336	-1·68
	5·6	3·2		1·2	15·8		6·2	3·6		1·4	15·6
15	·086	-8·82	105	·332	+2·30	195	+·091	+8·98	285	+·329	-2·46
	5·6	4·6		1·6	15·6		5·8	5·2		2·0	15·2
20	·114	-8·59	110	·324	+3·08	200	+·120	+8·72	290	+·319	-3·22
	5·4	6·0		2·2	15·2		5·4	6·4		2·4	14·6
25	·141	-8·29	115	·313	+3·84	205	+·147	+8·40	295	+·307	-3·95
	5·4	7·2		2·6	14·2		5·4	7·6		2·8	14·0
30	·168	-7·93	120	·300	+4·56	210	+·174	+8·02	300	+·293	-4·65
	5·0	8·4		3·2	13·8		5·2	9·0		3·4	13·4
35	·193	-7·51	125	·284	+5·25	215	+·200	+7·57	305	+·296	-5·32
	4·6	9·4		3·6	13·0		4·8	10·0		3·6	12·4
40	·216	-7·04	130	·266	+5·90	220	+·224	+7·07	310	+·258	-5·94
	4·4	10·4		4·0	12·2		4·4	11·2		4·0	11·6
45	·238	-6·52	135	·246	+6·51	225	+·246	+6·51	315	+·238	-6·52
	4·0	11·6		4·4	11·2		4·0	12·2		4·4	10·4
50	·258	-5·94	140	·224	+7·07	230	+·266	+5·90	320	+·216	-7·04
	3·6	12·4		4·8	10·0		3·6	13·0		4·6	9·4
55	·276	-5·32	145	·200	+7·57	235	+·284	+5·25	325	+·193	-7·51
	3·4	13·4		5·2	9·0		3·2	13·8		5·0	8·4
60	·293	-4·65	150	·174	+8·02	240	+·300	+4·56	330	+·168	-7·93
	2·8	14·0		5·4	7·6		2·6	14·4		5·4	7·2
65	·307	-3·95	155	·147	+8·40	245	+·313	+3·84	335	+·141	-8·29
	2·4	14·6		5·4	6·4		2·2	15·2		5·4	6·0
70	·319	-3·22	160	·120	+8·72	250	+·324	+3·08	340	+·114	-8·59
	2·0	15·2		5·8	5·2		1·6	15·6		5·6	4·6
75	·329	-2·46	165	·091	+8·98	255	+·332	+2·30	345	+·086	-8·82
	1·4	15·6		6·2	3·6		1·2	15·8		5·6	3·2
80	·336	-1·68	170	·060	+9·16	260	+·338	+1·51	350	+·058	-8·98
	0·8	15·8		6·0	2·2		0·6	16·0		5·8	2·0
85	·340	-0·89	175	·030	+9·27	265	+·341	+0·71	355	+·029	-9·08
	0·4	16·0		6·0	0·6		0·2	16·0		5·8	0·8
90	·342	-0·09	180	·000	+9·30	270	+·342	+0·09	360	·000	-9·12

(10) When my tables are computed—and this will in future require only about two hours' work per annum—I do not even

have to interpolate for odd minutes, because the various quantities required to correct the observed position are not applied separately to each star. Instead, a small table is computed for each day which gives :

(a) The sum of all corrections for -36° , and for each half hour of R.A. (clock error + reduction + $m + n \tan \delta$ + annual precession, &c.).

(b) The variation for an increase or decrease of 5° N.P.D.

For this purpose the corrections K_a , N_a , K_s , N_s are taken direct from the tables, the only interpolation being for N considered as a function of t , and this is very simple.

(11) I venture to suggest that much time might be saved in future if standard tables were computed and published, and it might also be practicable to publish annual tables.

Observations of Jupiter's Sixth Satellite, from Photographs taken at the Royal Observatory, Greenwich 1906 August.

(Communicated by the Astronomer Royal.)

Photographs of *Jupiter's* sixth satellite were obtained on 1906 August 28 and August 31 with the 30-inch reflector, with exposures of 28 mins. and 45 mins. respectively. *Jupiter* and the satellite and six reference stars, whose places were derived from the *Astronomische Gesellschaft Catalogue*, were measured, and the following right ascensions and declinations, with the corresponding position-angles and distances, deduced :—

Date and G.M.T.				Satellite VI.		Jupiter.		Deduced.	
				App. R.A.	App. Decl.	App. R.A.	App. Decl.	Pos. Angle.	Distance.
1906.	d	h	m	s	h	m	s		
Aug. 28	15	27	29	6 22 42.60	+ 22 37' 48".1	6 23 40.85	+ 23 3' 2".6	208.046	1715.2
31	15	28	32	6 54 58.69	+ 22 36 25.1	6 25 47.31	+ 22 1 58.7	203.708	1674.5

From the measures of *Jupiter* the apparent corrections to the tabular place are :—

				R.A.	Decl.
				^s	"
Aug. 28	...	...	...	— .06	+ 2.3
31	...	...	...	— .11	+ 1.8

The deduced position-angles and distances of the satellite reckoned from the tabular place of *Jupiter* would be

				Pos. Angle.	Distance.
Aug. 28	...	...	...	208.108	1713.6
31	...	...	...	203.781	1673.4